WORKSHOP TECHNOLOGY - I

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CHAPTER 1

Hand Tools

1.1. CHISELS

A chisel is a cutting/chipping tool having a sharpened edge at the end of a metal blade. Depending upon application, its edge can be beveled at a variety of angles. It is used to chip, carve or cut into a solid material (such as wood, stone or metal) often by driving with a mallet or hammer. It may also be provided with a handle which is made up of either wood or plastic.

Chiselling involves forcing the blade into some material to cut or carve it. The driving force may be applied by pushing with hand or by using a mallet or hammer. In industrial use, a hydraulic ram or falling weight (trip hammer) may be used to drive a chisel into the material.

Nowadays, chisels are made from high carbon steel or chrome vanadium steel and depending upon use, are made in various sizes and degrees of hardness.

The main parts of a wood chisel include the steel hoop, handle, ferrule, tang, bolster, neck, blade, bevel and the cutting edge.

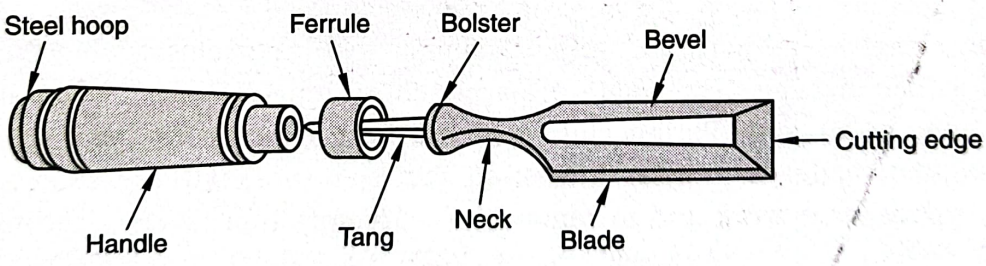


Fig. 1.1. Parts of a wood chisel.

Uses of chisels : Chisels are known for their wide applications such as edges refining, mortice cleaning, cuts and joints. Chisels are also used for cutting and shaping wood and stone. In sheet metal, they are used for cutting sheets, rivets and bolts.

Types of chisels : The various types of chisels are as follows :

1. Chisels used in carpentry
2. Chisels used in fitting
3. Chisels used in smithy
4. Chisels used in sheet metal

5. Stone chisel
6. Masonry chisel.

1. Chisels used in carpentry : In the carpentry shop, a large number of chisels are used for cutting the wood. The common types of chisels as follows :

(*i*) Firmer chisel : It is a general purpose chisel used to finish the inside grooves of any wood. It has various sizes of cutting edge depending upon the work to be done. The width of blade varies from 3 mm to 38 mm and is rectangular in cross-section. It may be used either by hand pressure or by blows from a mallet.

Fig. 1.2. (*a*) Firmer chisel.

(*ii*) Dovetail chisel : This type of chisel is used in case of dovetail joints and other 'V' grooves etc. The blade is provided with a bevelled edge to reduce the blade thickness on both sides so that it can enter narrow corners to finish well where the ordinary firmer chisel is unsatisfactory due to its thick sides.

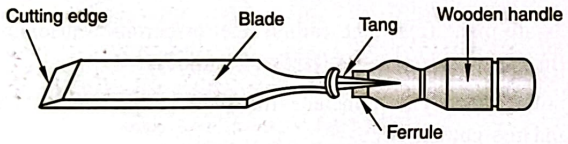


Fig. 1.2. (*b*) Dovetail chisel.

(*iii*) Paring chisel : The paring chisels are similar to Firmer chisels, but they have a long thin blade and a sharper edge. The length of paring chisel ranges from 225 mm to 500 mm and width from 5 mm to 50 mm. Paring chisels should be used only for hand-guided work and never struck with a mallet or blows. It is used for deep work (where shorter firmer chisel cannot reach), for delicate work and to remove an extremely thin layer of the woodwork from the workpiece.

(*iv*) Mortise chisel : It is used to make mortises and is used for making heavy and deep cuts. The maximum width of blade in commonly used chisel is upto 15 mm and thickness varies from 5 mm to 12 mm. Because of more thickness its blade is stronger than the other chisels and hence can take heavy blows.

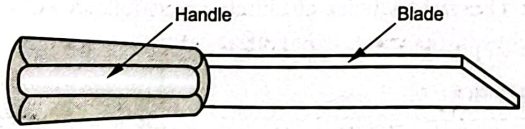


Fig. 1.2. (*c*) Mortise chisel.

(*v*) Socket chisel : The socket chisel is similar to firmer chisel with the difference that in socket chisel, a socket type construction is provided at the end of its blade. Whereas in firmer

chisel, a tang is provided at the end of blade. In the socket chisel, a wooden handle is fitted into the socket provided at the end of the blade. This prevents the handle from breaking as the chisel is to be subjected to heavy blows. It functions as a mortising chisel and may be used for general cutting work.

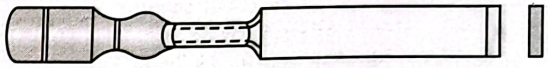


Fig. 1.2. (*d*) Socket chisel.

(*vi*) Gouges : A gouge is a type of chisel having curved cross-section instead of flat. A gouge typically has a 'U'-shaped cross-section. It is mostly used to scoop or form the curved surfaces or holes. It is of two types *i.e.* inside ground gouge and outside ground gouge. It is available in different sizes and types as per requirement of work.

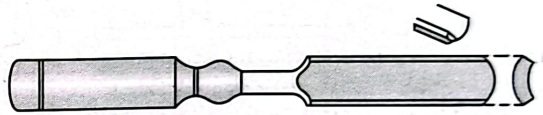


Fig. 1.2. (*e*) Outside ground gouge.

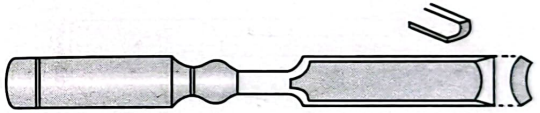


Fig. 1.2. (*f*) Inside ground gouge.

2. Chisels used in fitting : These chisels are used for chipping away the material from the workpiece and are about 8 inches long. The top of the chisel is flattened and the bottom has a sharp cutting edge. The classification of chisels is done on the basis of their shape and width of the cutting edge. Cutting edges of chisels have following angles :

(*i*) 70° to 75° – For hard materials

(*ii*) about 60° – For medium hard materials

(*iii*) about 40° – For soft materials.

The various types of chisels commonly used in fitting are as follows :

(*i*) Flat chisel : This type of chisel is about 1 inch wide at the cutting edge and is used for chipping flat or narrow surfaces, cutting sheet metal, bars and rivets. Its cutting edge should be slightly rounded to prevent the corners digging in when it is being used.

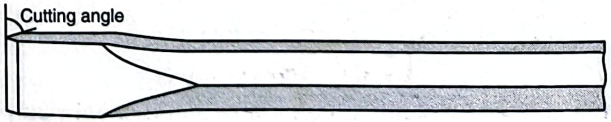


Fig. 1.3. (*a*) Flat chisel.

(ii) Cross-cut chisel : This type of chisel is 1/4 inch to 3/4 inch wide at the cutting edge and is used for cutting the grooves, slots and keyways etc.

Fig. 1.3. (*b*) Cross-cut chisel.

(iii) Half-round chisel : This is similar to the cross-cut chisel but the cutting edge is semi-circular. It is used for cutting semi-circular or round bottom grooves.

Fig. 1.3. (*c*) Half-round chisel.

(iv) Diamond-point chisel : It is a special purpose chisel used for chipping rough plates, and cutting cast iron pipes, cutting 'V' grooves, squaring up corners of previously cut slots and cleaning angles.

Fig. 1.3. (*d*) Diamond-point chisel.

(v) Side chisel : A side chisel is particularly useful in chipping and removing surplus metal in cotter ways and slots, which may have to be cut by hand after drilling.

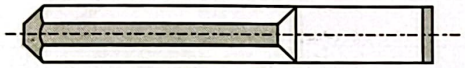


Fig. 1.3. (*e*) Side chisel.

Chipping operation with a chisel : First of all, the workpiece is clamped into the vice. Hold the chisel at an angle (30°) with the work as to obtain an even chip of the right depth. Keep your eye on the cutting edge of the chisel and strike it at the top with a chipping hammer. It should be noted that the chisel should be firmly gripped in one hand leaving about 3 to 5 cm length above the thumb of the hand and hammer should be held near the end of the handle to ensure more power in the blows. The operator should stand erect with his two feet sufficient apart to balance his own weight.

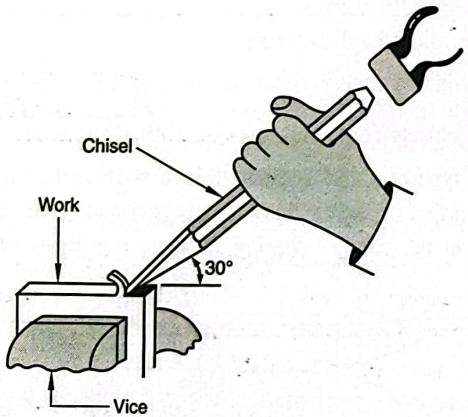
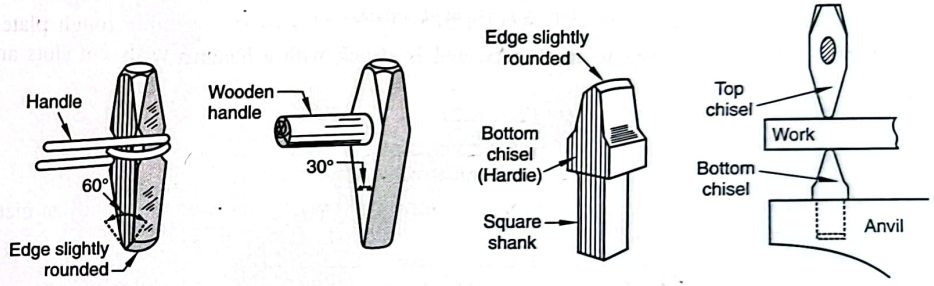


Fig. 1.4. Chipping operation.

3. Chisels used in smithy : These chisels are used for cutting the metal piec... nicking prior to breaking. They may be hot or cold. Hot chisel is used to cut the metal in hot state and cold chisel in cold state. The main difference between these two chisels is only the cutting angle. In hot chisel, the cutting angle is 30° to 45°, whereas in cold chisel, the cutting angle is 50° to 70°. The edge of a chisel is made slightly rounded for better cutting action.

The chisels are generally used in pairs. The top chisel may be hot or cold chisel. The bottom chisel, also known as hardie, has a square shank which fits in the square hardie hole in the anvil.



(*a*) Cold chisel. (*b*) Hot chisel. (*c*) Bottom chisel (Hardie). (*d*) Use of chisels.

Fig. 1.5.

4. Chisels used in sheet metal : In sheet metal, chisels are used for cutting sheets, rivets, bolts etc. These are cold chisels and are hexagonal or octagonal in shape. Various types of chisels are used in sheet metal, but the flat chisel and round nose chisel are mostly used.

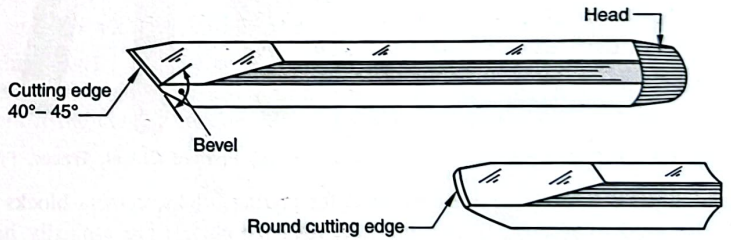


Fig. 1.6.

5. Stone chisel : Stone chisels are used to carve or cut stone, bricks or concrete slabs. To cut stone, a brick bolster is used. To increase the force, stone chisels are often hit with club hammers, which is a heavier type of hammer. Stone chisels are carbide tipped or are made up of high carbon steel. Although there are various types of chisels used in stone cutting and carving, yet the following are commonly used :

Pointed chisel : This chisel is used for small detailed work and getting rid of high points. (See Fig. 1.7)

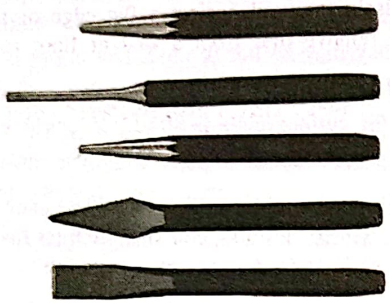


Fig. 1.7. Pointed chisel.

Tracer : This chisel is used to split stone and is struck with a hammer.

Fig. 1.8. Tracer.

Pitching tool : It is used to chop off visible areas.

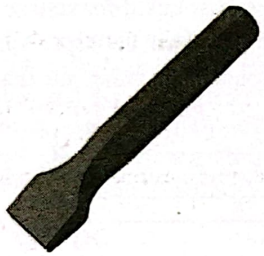


Fig. 1.9. (*a*) Pitching tool.

Fig. 1.9. (*b*) Pointed Chisel, Tracer, Pinching tool.

6. Masonry chisel : Masonry chisels are used for cutting bricks, cement blocks and cinders. They can also be used to remove excess mortar. Masonry chisels are typically heavy, with a relatively dull head that wedges and breaks, rather than cuts. These chisels may be mounted on a hammer drill, jackhammer or hammered manually. Types of masonry chisels include the following :

(*i*) **Moil (point) chisels :** Moil chisels have a sharp, tapered tip to pierce and drive through concrete, brick etc. The point chisel is used with a metal hammer or a wooden mallet and is the basic chisel mostly used for carving. These are also used to break materials in cleanup and demolition tasks.

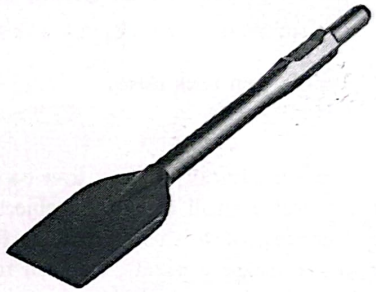
Fig. 1.10. (*a*) Moil point chisel.

(*ii*) **Flat chisels :** Flat chisels are used against a flat edge or for a straight line. These chisels are commonly used to remove tiles from a wall or floor as well as breaking concrete slabs. [See Fig. 1.10 (*b*)]

(*iii*) **Asphalt cutter :** These masonry chisels have sharpened edges for faster and more precise breaking up of hard-packed gravel or asphalt. These are suitable for demolition and chiseling jobs. [See Fig. 1.10 (*c*)]

(*iv*) **Carbide bushing tool :** A carbide bushing tool has a cube-shaped head with many sharp points on one side. It is used for leveling concrete surfaces and removing excess concrete during finishing work. Additionally, this tool can also texturize concrete. [See Fig. 1.10 (*d*)]

(*b*) Flat chisel.



(*c*) Asphalt cutter chisel.

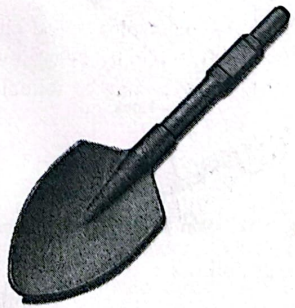
(*d*) Carbide bushing tool.

Fig. 1.10.

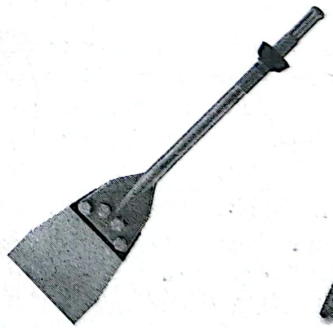
(*v*) **Clay spade :** A clay spade chisel looks similar to a spade shovel and is suitable for digging into clay material. [See Fig. 1.10 (*e*)]

(*vi*) **Flexible chisel :** A flexible chisel is suitable for removing soft material (*e.g.*, carpet) from a harder surface without damaging the lower surface. [See Fig. 1.10 (*f*)]

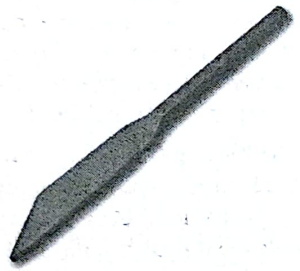
(*vii*) **Plugging chisel :** A plugging chisel has a tapered edge for cleaning out hardened mortar. The chisel is held with one hand and struck with a hammer. The direction of the taper in the blade determines if the chisel cuts deep or runs shallow along the joint. [See Fig. 1.10 (*g*)]



(*e*) Clay spade chisel.



(*f*) Flexible chisel.



(*g*) Plugging chisel.

Fig. 1.10.

(h) Brick chisel : Brick chisels have a wider blade for cracking through masonry blocks rather than cutting them.

Fig. 1.10. (*h*) Brick chisel.

1.2. HAMMER

A hammer is a striking tool, which consists of a heavy iron body fixed to a long handle which is swung to deliver an impact over a small area of an object. It may be a hand tool driven by a human arm or a power hammer, which is used to deliver forces beyond the capacity of the human arm. Hammers are used to shape a metal ; to crush rocks ; to drive nails into wood ; for striking chisels in chipping/cutting operations ; for working with a punch, for riveting work, for breaking and for other non-destructive striking applications. Hammers vary in shape, size and structure depending upon the purpose for which they are to be used. The hammer head is generally made up of steel and the handle is typically made of wood or plastic. Its face must be hardened and tempered.

The main parts of a hammer are shown in Fig. 1.12.

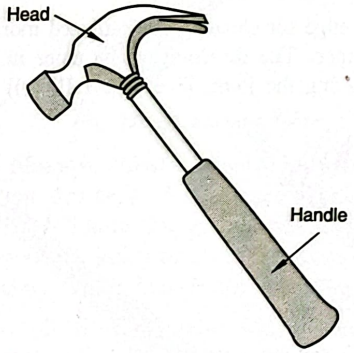


Fig. 1.11. Claw hammer.

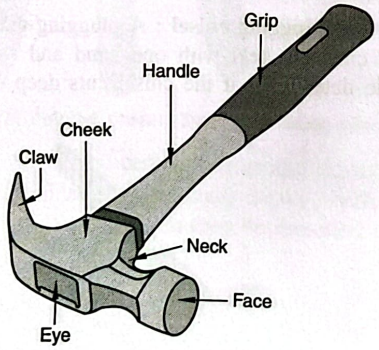


Fig. 1.12. Main parts of a hammer.

Types of hammers : The various types of hammers are as follows :

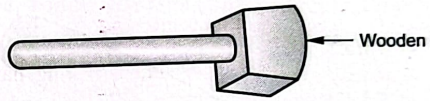
1. Hammers used in carpentry
2. Hammers used in fitting

3. Hammers used in sheet metal
4. Hammers used in smithy/forging.

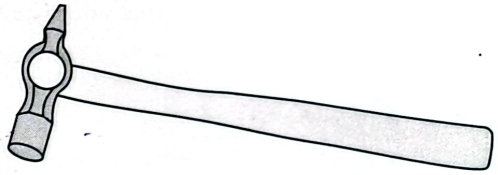
1. Hammers used in carpentry : Striking tools or Hammers used in carpentry are as follows :

(*i*) Mallet : It is made up of hard wood and is round or rectangular in shape with a wooden handle. It is used to strike the cutting tools, which have a wooden handle. [See Fig. 1.13 (*a*)]

(*ii*) Warrington hammer or Cross peen hammer : Warrington hammer is preferred for work that requires precision. The cross peen side is used for refining work, such as furniture and cabinet making. A Warrington hammer consists of head, face, peen and handle. Its body is made up of steel and a wooden handle. [See Fig. 1.13 (*b*)]



(*a*) Mallet.



(*b*) Warrington hammer or Cross peen hammer.

Fig. 1.13.

(*iii*) Claw hammer : It is used for striking as well as for pulling out the nails from the wood. It is made up of cast steel and it carries the striking face at one end and the claw at the other end. Its size is designated by its weight and it varies from 200 gram to 750 gram.

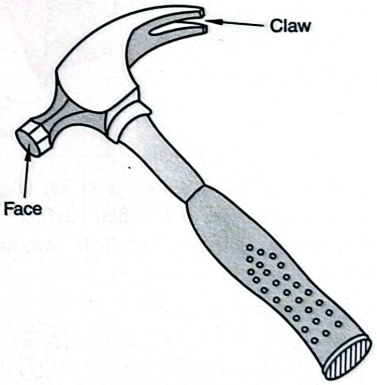


Fig. 1.13. (*c*) Claw hammer.

2. Hammers used in fitting : The two ends of this hammer *i.e.* face and peen must be hardened and tempered. Various types of hammers used in Fitting shop are as follows :

(*i*) Ball peen hammer : It is the most common type of hammer and is mainly used for chipping and riveting. It has a hardened ball shaped peen at one end and a face at the other. [See Fig. 1.14 (*a*)]

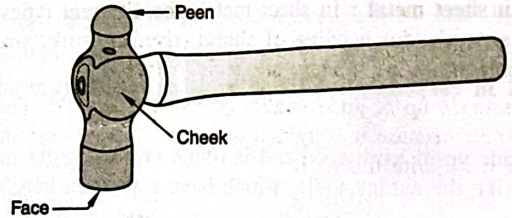
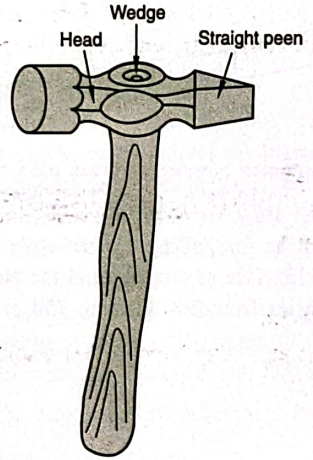


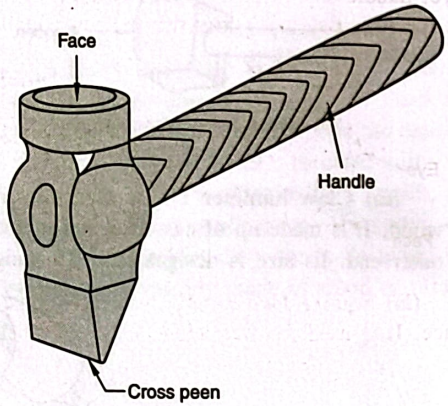
Fig. 1.14. (*a*) Ball peen hammer.

(*ii*) **Straight peen hammer :** In straight peen hammer, the peen is parallel to the handle. It is used for stretching or peening the metal. [See Fig. 1.14 (*b*)]

(*iii*) **Cross peen hammer :** In cross peen hammer, the peen is perpendicular to the handle. It is used for bending, stretching, hammering into shoulders, inside curves etc. [See Fig. 1.14 (*c*)]



(*b*) Straight peen hammer.



(*c*) Cross peen hammer.

Fig. 1.14.

(*iv*) **Soft hammer :** Soft hammer is used where it is necessary to strike a metal with the minimum damage to the surface, for example, a finished surface. This surface would otherwise be damaged if a hardened face hammer is used. The Soft hammers are made up of raw hide, hard rubber, lead, wood, copper and brass.

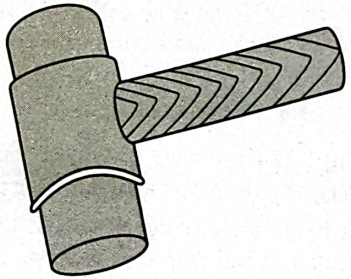


Fig. 1.14. (*d*) Soft hammer.

3. Hammers used in sheet metal : In sheet metal, for different types of works hammers are used. For example, for bending of sheets, riveting work, smoothening of sheets, locking of joints etc., the following hammers are mainly used :

(*i*) **Mallet :** Mallet is made up of good quality of wood or plastic. The use of mallet does not spoil the surface of sheet because it is light in weight. It is used for smoothening of sheet. Less force is required to work with this tool.

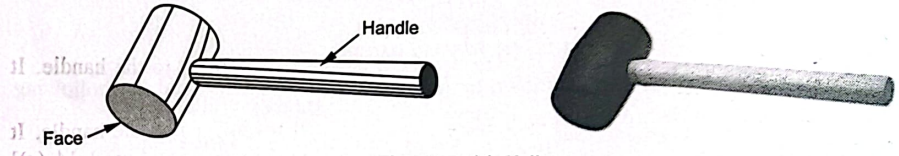


Fig. 1.15. (*a*) Mallet.

(*ii*) **Ball peen hammer :** All the hammers are mainly divided into four parts *i.e.*, peen, eye, handle and face. The peen is top part made slightly tapered from the cheeks and rounded at the top. Ball peen hammer is shown in Fig. 1.15 (*b*).

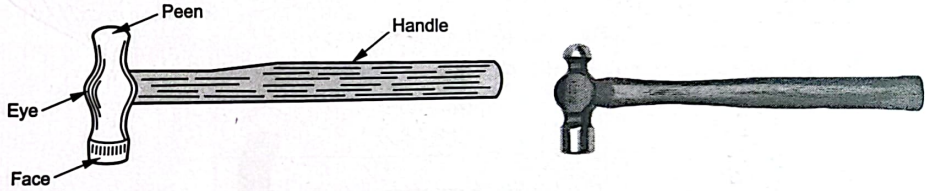


Fig. 1.15. (*b*) Ball peen hammer.

(*iii*) **Square face hammer :** This hammer also known as setting hammer has a square flat face. It is used for flattening the seams in sheet metal work.

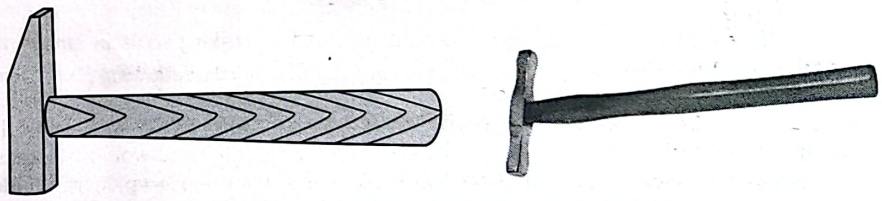


Fig. 1.15. (*c*) Setting hammer or Square face hammer.

(*iv*) **Raising hammer :** This type of hammer is used to convert flat surface of sheet to curved surface. It is used with raising block, that is why it is called raising hammer.

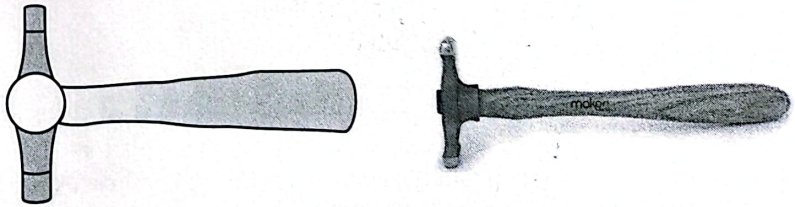


Fig. 1.15. (*d*) Raising hammer.

(e) Riveting hammer : This type of hammer is used to convert flat surface of sheet to curved surface. It is used with raising block, that is why it is called raising hammer.

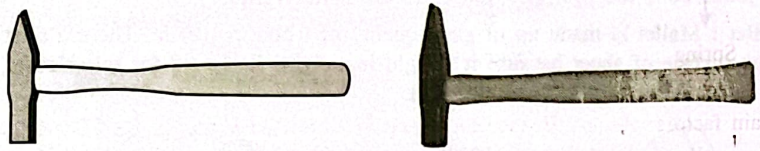


Fig. 1.15. (e) Riveting hammer.

(vi) Blocking hammer : It is also known as hollowing hammer. It is used for hollowing a disc of sheet metal into a dish or bowl shape.

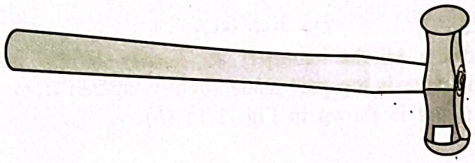


Fig. 1.15. (f) Blocking hammer.

(vii) Planishing hammer : A planishing hammer is used on domed circular work.

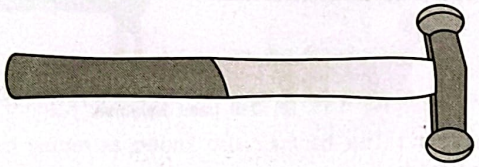
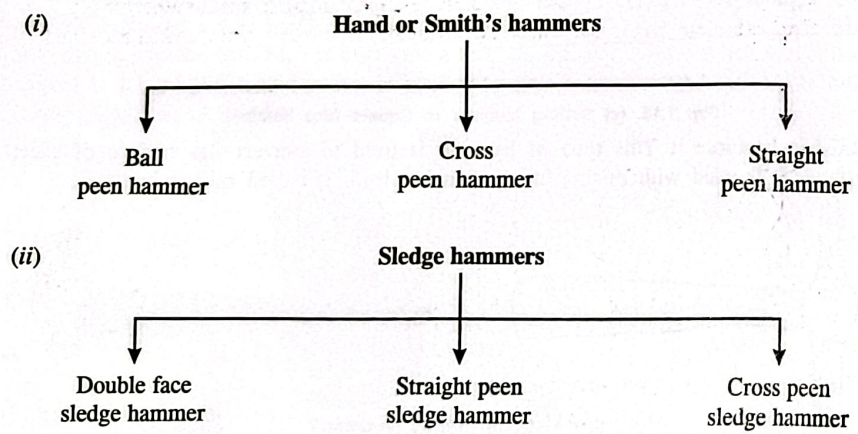
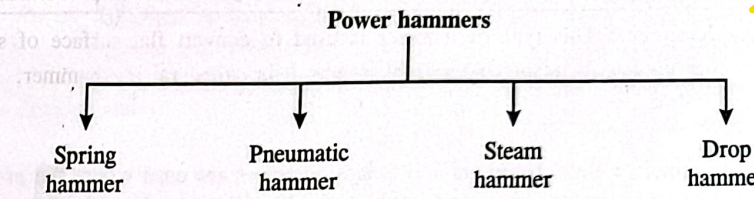


Fig. 1.15. (g) Planishing hammer.

4. Hammers used in smithy/forging : Hammers are used as striking tools in smithy shop and these are made up of forged steel. These hammers are classified as the following :





The main factors which influence the working of hammers are as the following :

(a) As per the size and shape of the job.

(b) Falling weight of the hammer.

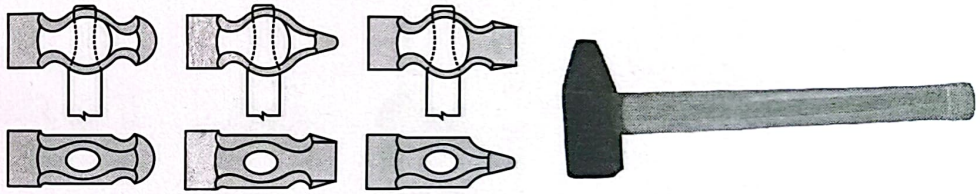
(c) Height of falling weight.

(i) Hand hammers : Hand hammers as per name are used by the blacksmith himself. They are light in weight and small in size. The main parts of the hand hammer are peen, neck, eye hole, face and wooden handle etc. The weight of the hand hammer varies from 1 kg to 3 kg. Hand hammers are :

(a) Ball peen hammer.

(b) Cross peen hammer.

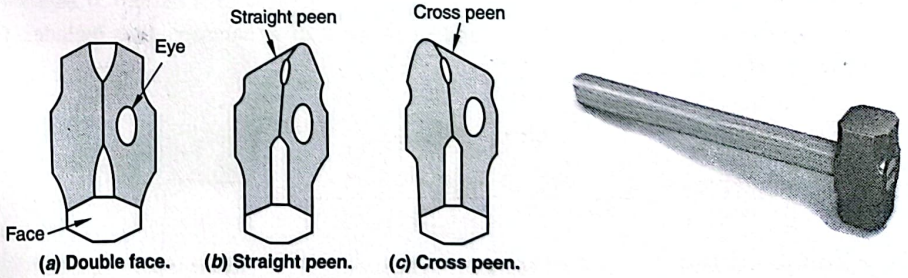
(c) Straight peen hammer etc.



(a) Ball peen. (b) Cross peen. (c) Straight peen.

Fig. 1.16. Hand hammers.

(ii) Sledge hammers : A sledge hammer is heavier than hand hammer and is used by blacksmith's helper who is called as hammer man. Sledge hammers are comparatively 3 to 4 times heavier than the hand hammers. These are available in various sizes and shapes and their weight varies from $3\frac{1}{2}$ kg to 10 kg. Sledge hammers are as shown in Fig. 1.17.



(a) Double face. (b) Straight peen. (c) Cross peen.

Fig. 1.17. Sledge hammers.

Sledge hammers are :

(a) Double face sledge hammer.

(b) Straight peen sledge hammer.

(c) Cross peen sledge hammer.

(iii) Power hammers : Hand hammers and sledge hammers are used where the production of jobs is limited to small forging operations only and where the quantity of jobs production is required more, power hammers are used. Commonly used power hammers are :

(a) Spring hammers.

(b) Pneumatic hammers.

(c) Steam hammers.

(d) Drop hammers.

Power hammers are shown in Fig. 1.18 and are generally driven by electrical power. The weight of power hammer is varied from 50 kg to above 300 kg.

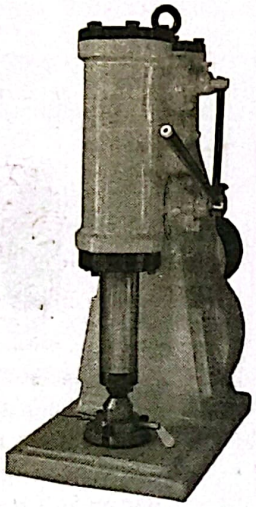
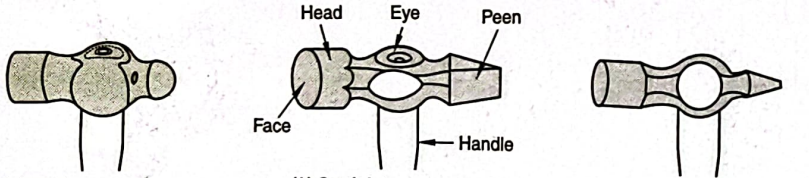


Fig. 1.18. Pneumatic power hammer.

Basic Design and Variations

The Fig. 1.19 shows the basic design and main parts of a hammer, that includes face, head, eye, peen and handle.



(a) Ball peen hammer. (b) Straight peen hammer. (c) Cross peen hammer.

Fig. 1.19. Basic design of a hammer.

The word "hammer" is used here in a general sense to cover the wide variety of striking tools such as carpenter's or claw hammer, mallet, maul etc. The best known tool designated by the name hammer is the carpenter's hammer. The claw of a carpenter's hammer is frequently used to remove nails.

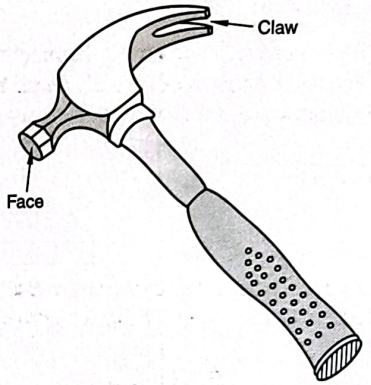


Fig. 1.20. Carpenter's hammer.

A mallet is a tool used for imparting force on another object. It is generally made up of rubber or wood and usually has a relatively large head.

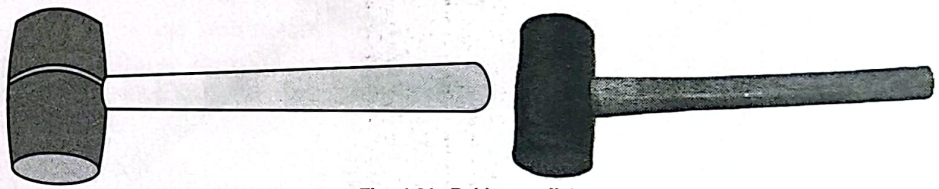


Fig. 1.21. Rubber mallet.

The impact between the steel hammer head and the object being hit can create sparks, which may ignite flammable or explosive gases present in hazardous environments such as petroleum refineries, chemical plants, underground coal mining etc. In these environments, a variety of non-sparking metal hammers are used, primarily made of brass, aluminium or beryllium copper.

A splitting maul also known as block splitter is a heavy, long-handled hammer used for splitting a piece of wood along its grain. One side of its head is like a sledgehammer and the other side is like an axe.

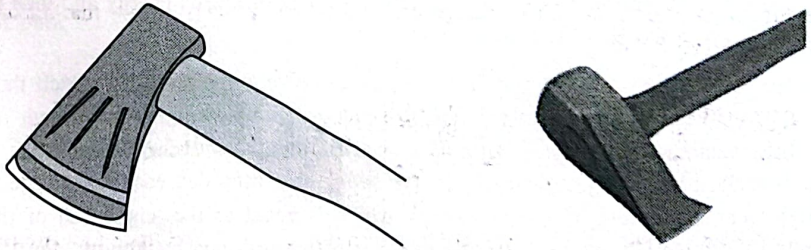


Fig. 1.22. Splitting maul.

...ead blow hammer consists of a hollow head filled with sand, lead shot or pellets. Due to ..., it delivers impact with a very little recoil. (See Fig. 1.23)

A Gavel is a small hammer with which an auctioneer, a judge or a presiding authority hits a surface to call for attention. (See Fig. 1.24)

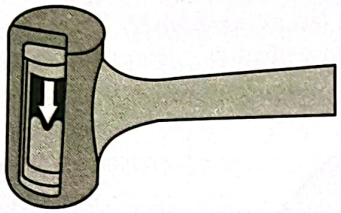


Fig. 1.23. Dead blow hammer.

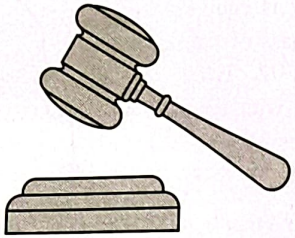


Fig. 1.24. Gavel.

A Chipping hammer consists of a striking head with a sharp conical point and a flat chisel bevelled end. It is used for cutting, deburring, cleaning, hole-making, edge cutting and light demolition. It is also used to clean and remove slag from welds.

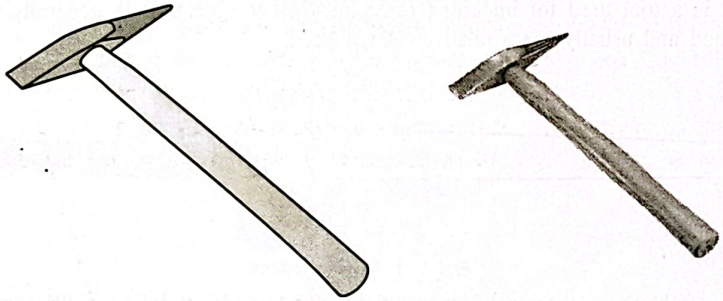


Fig. 1.25. Chipping hammer.

Power hammers such as steam hammer, drop hammer etc. often look quite different from the hand tools, but nevertheless, most of them work on the same principle.

Physics of Hammering : A hammer acts by converting mechanical work into kinetic energy and then kinetic energy back into work upon hitting the surface or tool. In the swing that precedes each blow, the hammer head stores a certain amount of kinetic energy and then transfers this kinetic energy to the surface or tool upon hitting.

Hammer as Force Multiplier : A hammer acts as a force multiplier in which the impact force of the weighted head fixed to the handle is increased by swinging it through a certain distance. In a hammer, mechanical work is converted into kinetic energy and then back to mechanical work upon hitting the target. In the swing that precedes each blow, the hammer head stores a certain amount of kinetic energy which is equal to the length (L) of the swing multiplied by the force (F) produced by the muscles of the arm and by gravity. Further, when

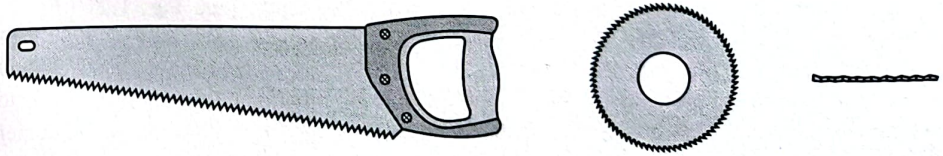
the hammer is swung, the handle extends the effective length of the arm and thus ... end of the hammer sweeps a larger arc. This means that there is more time for arm muscles to ... it and thereby the impact force of the hammer gets multiplied.

Effect of Head's Mass : Since, the amount of energy transferred to the target by the hammer-blow is equivalent to the kinetic energy at the time of impact which is equal to one half of the mass of the head multiplied by the square of the head's speed at the time of impact *i.e.* $E = mv^2/2$. While the energy delivered to the target increases linearly with mass and quadratically with speed. Therefore, High tech titanium heads have less mass and allow for longer handles, due to which the end of the hammer sweeps a larger arc, thus increasing velocity and delivering the same energy with less arm fatigue than that of a heavier steel head hammer.

Effect of Handle : The handle of the hammer helps in several ways. It provides a broad area that is better-suited for gripping by the hand. It keeps the user's hands away from the point of impact. A longer handle allows the user to maximize the speed of the head and thus impact force on each blow. But the primary constraint on additional handle length is the lack of space to swing the hammer. That is why sledge hammers are largely used in open spaces. The second constraint is that the longer the handle, the harder it is to guide the head of the hammer to its target at full speed. Besides, it may also deliver force off-target or at the wrong place. Thus, with too long a handle, the hammer is inefficient because it may deliver force at a wrong place and with too short a handle, the hammer is inefficient because it may not deliver enough force. Therefore, most designs are a compromise between practicality and energy efficiency. Handles are also made of shock-absorbing materials to reduce the effect of the hammer on user.

1.3. SAW

A saw consists of a thin metallic blade having a series of sharp teeth on one edge or a thin metal disc with teeth on the periphery. Generally the teeth are bent alternately to the right and left side as shown in Fig. 1.26 (*c*) so that the groove cut by the saw is wider than the thickness of the saw blade. This arrangement of teeth enables the saw to easily pass through the cut being formed and with minimum friction. Each tooth cuts away a small portion of material. At one end of the blade, a wooden handle is fitted by riveting. The saws are available in various shapes and sizes. The size of the saw is generally specified by the length of the blade and pitch of teeth in mm.



(*a*) Saw. (*b*) Saw. (*c*)

Fig. 1.26.

1.2 Saw Terminology

Some important terms used in connection with saw are as under and are represented in Fig. 1.27 (*a*).

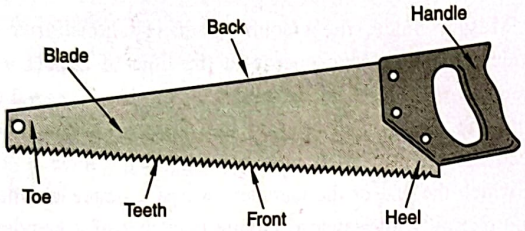


Fig. 1.27. (*a*)

1. Back : The longitudinal edge of the blade opposite to the toothed edge is called back. [See Fig. 1.27]

2. Heel : The end of the saw closest to the handle is known as heel. [See Fig. 1.27 (*a*)]

3. Toe : The end of the saw farthest from the handle is known as toe. [See Fig. 1.27 (*a*)]

4. Set : The alternate sideways bending of teeth to the right or left of the blade is known as set. This arrangement makes the cut wider than the blade itself and allows the blade to move through the cut easily without getting stuck. [See Fig. 1.27 (*b*) and (*c*)]

5. Kerf : The width of the saw cut or the width of the narrow channel left behind by the saw while cutting is called kerf. The kerf depends upon several factors such as the thickness of the saw blade, the set of the blade's teeth, the amount of wobble created during cutting and the amount of material pulled out of the sides of the cut. [See Fig.1.27 (*b*) and (*c*)]

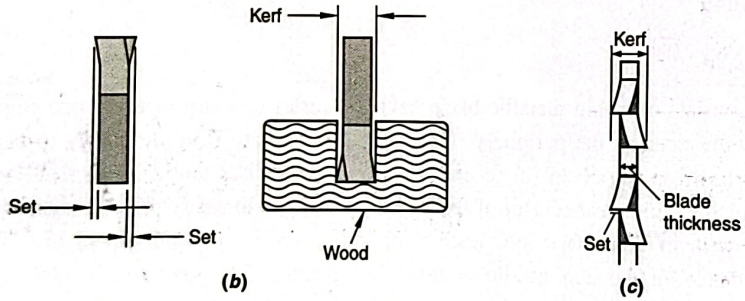


Fig. 1.27.

6. Gullet : The valley between the points of the teeth is known as gullet. The distance between the tooth tip and bottom of the gullet is called gullet depth. [See Fig. 1.27 (*d*)]

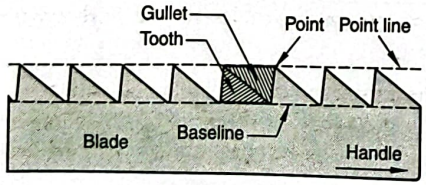


Fig. 1.27. (*d*)

7. Tooth face : The surface of the tooth on which the chip is formed is known as tooth face. [See Fig. 1.27 (*e*)]

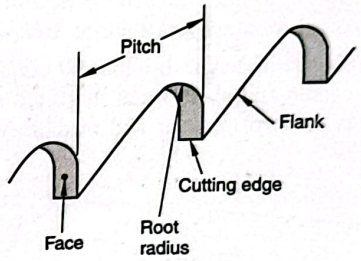


Fig. 1.27. (*e*)

8. Pitch : The distance between the adjacent cutting edges is called pitch. [See Fig. 1.27 (*e*)]

9. Fleam : Fleam, also known as bevel, is the angle that the front (face) of the tooth makes with a line drawn perpendicular to the plane of the saw blade [See Fig. 1.27 (*f*)]. The main effect of fleam is on the smoothness of the cut. A saw will cut more cleanly as its fleam is increased, but this increase in fleam makes the teeth weaker.

10. Rake : Rake is the angle that the front (face) of the tooth makes with a line perpendicular to the length of the saw blade [See Fig. 1.27 (*g*)]. Rake determines the aggressiveness of the saw cut.

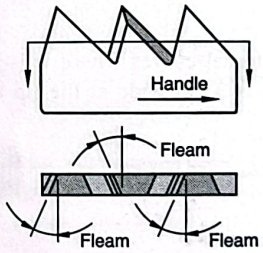


Fig. 1.27. (*f*)

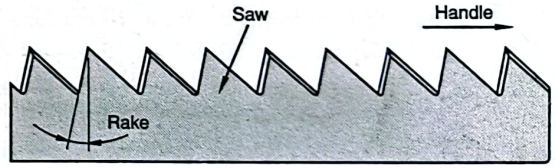


Fig. 1.27. (*g*)

Types of Saws : In all types of wood work, the cutting operation is to be performed by a hand saw. It consists of two main parts: the Blade which carries the cutting teeth and the other is a wooden handle for holding the saw during cutting operation to apply pressure. The saws are generally divided into two groups *i.e.* Pull saws and Push saws. Mostly the Push saws are used more than the Pull saws.

1. Pull saws : When the cutting of wood takes place during the return stroke of the saw, then such saws are known as Pull saws. In these saws, the cutting action takes place when the saw is pulled by the operator towards his side. These are generally used to cut thin wooden sheets.

Push saws : When the cutting of wood takes place during the forward stroke of the saw, such saws are known as Push saws. In these saws, the cutting action takes place when the saw is pushed by the operator away from his side. These are used in general cutting of wood.

The common types of saws used in wood work are as follows :

(*i*) Rip saw : It is a hand saw and its length is about 70 cm. The blade of this saw is about 12 cm to 20 cm wide near the handle and about 6 cm to 10 cm near the toe. It carries 2 teeth per cm length of the blade. It is used for smaller and medium works. A rip saw is shown in Fig. 1.28 (*a*).

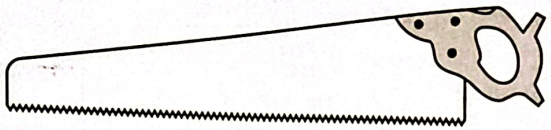


Fig. 1.28. (*a*) Rip saw.

(*ii*) Compass saw : It carries a tapered narrow blade having length about 45 cm. The width of the blade is 2.5 cm near the toe and 5 cm near the handle. It is used for cutting sweeps and large interior curves by hand. For internal cutting, a hole is first drilled and then the saw blade is inserted in it to commence the cut. In compass saw, the blade contains about 12 teeth per cm length and sometimes it is known as table saw.

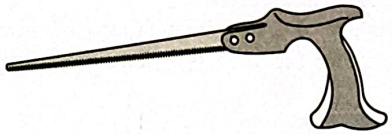


Fig. 1.28. (*b*) Compass saw.

(*iii*) Keyhole saw or Pad saw : It is used for cutting thick internal curves where it is not possible to use other saws. It has 20 cm to 30 cm long blade and is 3 cm wide at the tip and 6 cm wide near the handle.

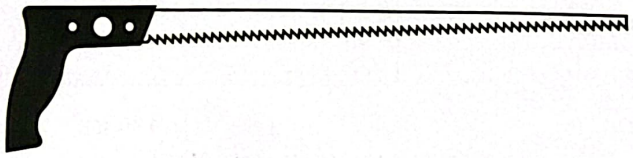


Fig. 1.28. (*c*) Keyhole saw.

(*iv*) Cross-cut saw : It is a saw provided with two handles one at each end. It is used for cutting the hard wood. It is 70 cm in length and in per cm length there are 3 to 4 teeth. A common shape of two man cross-cut saw is shown in Fig. 1.28 (*d*).

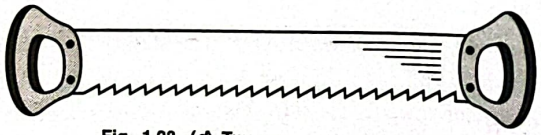


Fig. 1.28. (*d*) Two man cross-cut saw.

(*v*) Tenon saw or Back saw : The name of this saw is from tenon form of length of tenon type saw blade is 25 cm to 40 cm and width of blade is 6 cm to 10 cm. The teeth of the blade are approximately 5 to 8 in number per cm length and is used for taking short straight cut and the blade does not bend during the operation and a straight cut is obtained. The back of this saw is supported by wrought iron or brass, hence it is also called back saw.

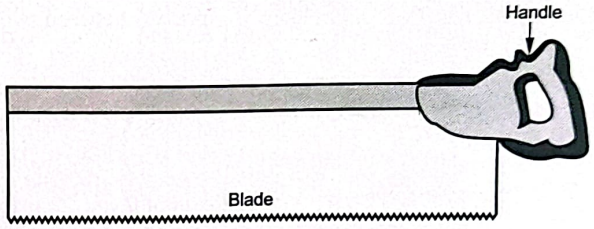


Fig. 1.28. (*e*) Tenon saw.

(*vi*) Coping saw : A coping saw is a type of hand saw used to cut intricate external shapes and interior cut-outs in woodworking or carpentry. It is widely used to cut moldings to create coped rather than miter joints. It is occasionally used to create fretwork though it is not able to match a fretsaw in intricacy of cut, particularly in thin materials.

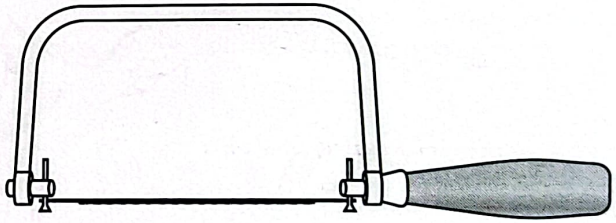


Fig. 1.28. (*f*) Coping saw.

(*vii*) Bow saw : It consists of a wooden frame, a connecting bar, a string, lever and two handles on both sides. The blade is tightened with the help of string and lever. Its blade is thin and narrow and have flexible body. It is used to produce finer curved surfaces with quick turns.

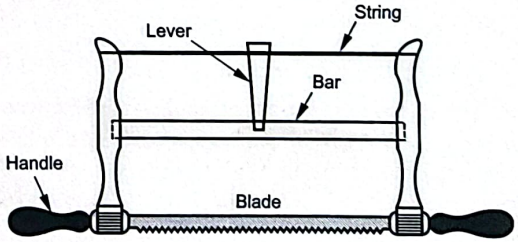


Fig. 1.28. (*g*) Bow saw.

Setting of saw teeth : The process of bending the alternate teeth of a saw in opposite directions is known as setting of teeth. A tool used for this process is called saw set. The width

of the blade at the cutting edges is called the total set. It is made to form a clearance between the cutting edges so that the saw may work without any restriction and also reduces the power to drive the saw.

Types of Saw Blades : The various types of saw blades are as follows :

1. Band saw blade : A band saw blade is a long metallic blade with teeth on one side and its two ends are joined together to form a circle. It is stretched between two or more wheels to cut the material.

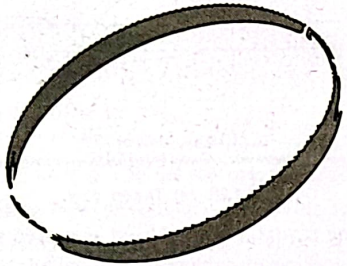
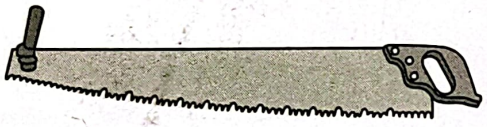
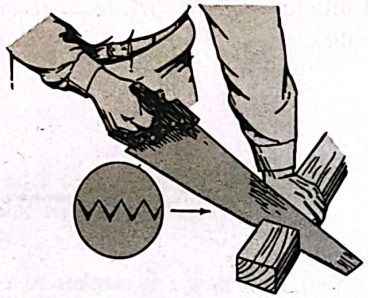


Fig. 1.29. (*a*) Band saw blade.

2. Crosscut saw blade : A crosscut saw is a saw designed for cutting wood at right angle (perpendicular or across) to the direction of the wood grain. Crosscut saws may be large or small.



Crosscut saw

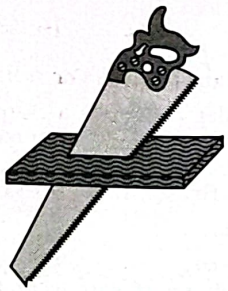


Use of crosscut saw

Fig. 1.29. (*b*)

3. Rip saw blade : A rip saw is a saw designed for making a rip cut *i.e.* a cut made parallel to the direction of the wood grain.

Rip saw



Use of Rip saw

Fig. 1.29. (*c*)

4. Plywood blade : A plywood blade is a circular saw blade with many small [illegible] on its periphery, which is designed for cutting plywood with minimal splintering.

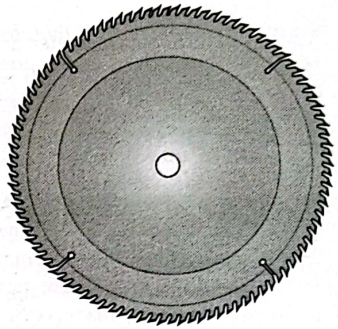


Fig. 1.29. (*d*) Plywood blade.

5. Dado blade : A dado blade is a special type of circular saw blade that is used to cut grooves into the wood that are much wider than the grooves cut by traditional saw blades, so that the edge of another piece of wood will fit into this groove to make a joint. A "stacked" dado blade, consisting of chipper blades between two dado blades, can be used to make grooves of different-width by adding or removing chipper blades. They are used for interlocking joint applications such as in making bookshelves, drawers, cabinets etc.

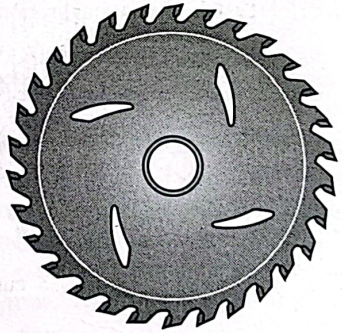


Fig. 1.29. (*e*) Dado blade.

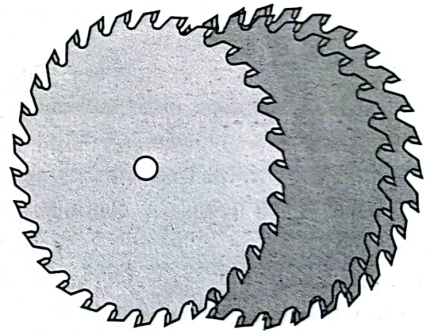


Fig. 1.29. (*f*) Stacked dado blade or Dado blade set.

Material used for saw : Most blade teeth are made either of tool steel or carbide. Carbide is harder and holds a sharp edge for much longer. There are several materials used in saws, which are as follows :

1. Brass : It is used to make the screws that in earlier times held the blade and the handle together.

2. Zinc : It was formerly used for saws used in kitchens to cut blocks of salt.

3. Copper : It is used as an alternative to zinc for salt-cutting saws.

4. Steel : Steel saw blades are relatively inexpensive and used in almost every existing kind of saw. High-speed steel (HSS) saw blades are harder than regular steel blades and stay sharp for longer periods of time.

5. Diamond : As diamond is a superhard material, therefore, diamond saw blades can be used to cut hard, brittle or abrasive materials, such as stone, concrete, asphalt, bricks, ceramics, glass etc.

6. Tungsten Carbide : Carbide-tipped blades are more expensive than steel and HSS blades, but remain sharp for even longer periods of time.

Hacksaw frame and its type : Hacksaw is the most commonly used tool for cutting of rods, flats, sheet metals etc. It consists of a narrow blade made up of high carbon steel or high speed steel. The frame of the hacksaw is made up from mild steel. The blade is placed inside the frame and is tightened with the help of a flange nut. The hacksaw should be used in straight direction. In case of improper use of it, blades can break. The length of the blade varies from 8″ to 14″ but most commonly 12″ blade is used in fixed frame hacksaw. The thickness and width of the blade are 1 mm and 3/4″ respectively. Blades are classified as under :

1. Depending upon the direction of cut :
   - (*i*) Forward cut
   - (*ii*) Backward cut.
2. Depending upon the pitch of the teeth :
   - (*i*) Coarse (8 – 14 teeth per inch) : It is used for cutting the wrought iron rolled having thick section.
   - (*ii*) Medium (16 – 20 teeth per inch) : It is used for cutting metals like steel, cast iron, aluminium, brass and copper etc.
   - (*iii*) Fine (24 – 32 teeth per inch) : It used for cutting the thin sections of metal sheets, tubes and conduits etc.

Types of hacksaw frames : Generally, there are two types of hacksaw frames as the following :

1. Fixed frame.
2. Adjustable frame.

Only one type of blade is used in fixed frame hacksaw, whereas the length of the frame can be increased or decreased as per requirement in adjustable frame hacksaw.

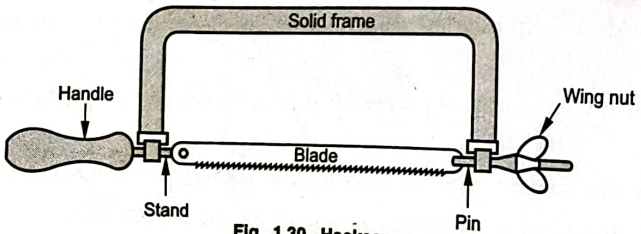


Fig. 1.30. Hacksaw.

Pitch of hacksaw : It is the number of teeth in one centimetre length of blade. Hacksaw blades with large pitch are used for thick section cutting whereas with small pitch are used for thin section cutting.

Teeth setting : Hacksaw blade teeth are set alternately outwards to opposite sides so that the width of the cut is wider than the thickness of the blade. As a result during complete operation, the blade is not in contact with the metal faces. This can reduce a lot of friction and increase the life of the blades and also the force required to push the saw is less and making the operation easier for the worker.

Use of hacksaw : The sawing operation is similar to that of filling. First of all mark the workpiece and then clamp into vice. Marking is done with the help of marker or punch or file. The handle of hacksaw is held in right hand and the left hand is kept on the frame. Start sawing at the marking, keeping the blade slightly tilted to the horizontal. The hacksaw should be moved perfectly straight. The speed of the hacksaw should be 25 – 30 strokes per minute. Water can be used as a coolant for sawing. Put sufficient pressure on the forward stroke and relief on the backward stroke. Sawing should be done steadily and slowly.

Care in the use of hacksaw : The following precautions should be observed while working with hacksaw :

- (*i*) To avoid breaking of the blade when cutting thin piece, place a wood piece behind the workpiece and hold tightly on vice.
- (*ii*) Do not use a new blade in a cut made by another old one because the new blade is thicker than an old blade which results in the breaking of hacksaw blade.
- (*iii*) Always tight the blade sufficiently.
- (*iv*) Do not tilt the frame while sawing.

Pliers : Function and Types

Different types of pliers are used in different shops for different purposes. In sheet metal, pliers are used for holding, cutting and bending work. In an electric shop, pliers are used for holding, twisting and cutting wires. Whereas, in electronic shop, pliers are used for holding wires in place during soldering, bending components, leads etc. Pliers have insulated sleeves on their arms. The various types of pliers commonly used are as follows :

1. Flat nose plier : A flat nose plier has flat jaws. It is used for shaping and bending flat metal and wire.

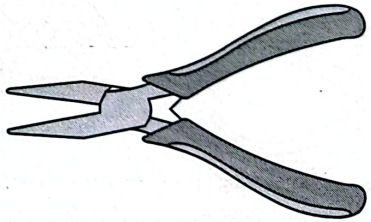


Fig. 1.31. (*a*) Flat nose plier.

Round nose plier : A round nose plier has long jaws of approximately round cross-section. It is used for holding and forming various shapes and patterns. [See Fig. 1.31 (*b*)]

3. Combination plier : It is used for holding, twisting and cutting wires. It is available in sizes 15 cm, 20 cm, 25 cm etc. [See Fig. 1.31 (*c*)]

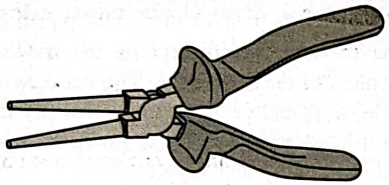


Fig. 1.31. (*b*) Round nose plier.

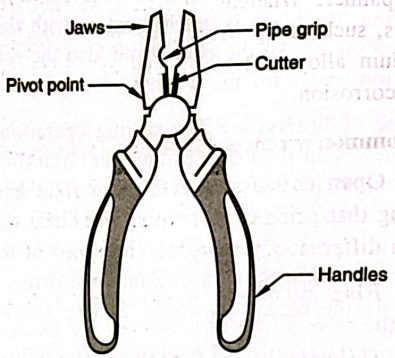


Fig. 1.31. (*c*) Combination plier.

4. Different types of pliers used in electronic shop are shown in the following figures :

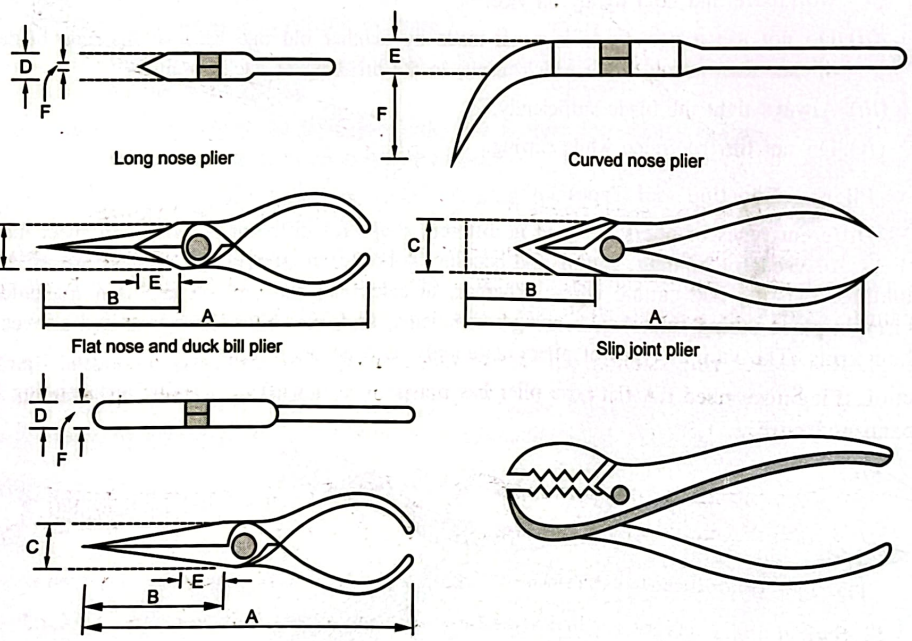


Fig. 1.31. (*d*) Different types of pliers.

1.4. WRENCHES/SPANNERS

A wrench or spanner is a hand tool which provides grip as well as mechanical advantage and is used to apply torque to turn the objects, such as nuts, bolts etc. Generally, the term spanner is a standard term. The most common shapes of spanners are open-ended spanner and ring spanner. Whereas, the term wrench is generally used for tools that turn non-fastening devices, such as tap wrench and pipe wrench. The wrenches are typically made from chromium-vanadium alloy tool steels and are often drop-forged. They are frequently chrome-plated to resist corrosion.

Common wrenches/Spanners : The commonly used wrenches/spanners are as follows :

1. Open ended spanner : An open ended spanner is a one-piece spanner with a U-shaped opening that grips two opposite faces of a nut or bolt. This spanner is generally double-ended, with a different-sized opening at each end. [See Fig. 1.32 (*a*)]

2. Ring spanner : A ring spanner is a one-piece spanner with an enclosed opening that grips the faces of the nut or bolt. The enclosed opening is generally a six-point or twelve-point opening. Generally, ring spanners are also double-ended, with a different-sized opening at each end. [See Fig. 1.32 (*b*)]

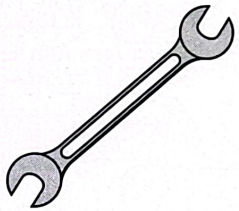


Fig. 1.32. (*a*) Open ended spanner.

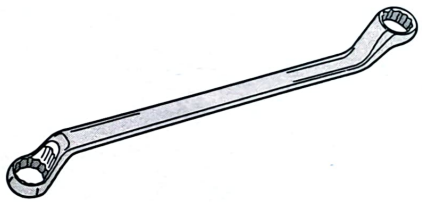


Fig. 1.32. (*b*) Ring spanner.

3. Combination spanner : It is also known as open-ring spanner. A combination spanner is a double-ended spanner with one end like an open-end spanner and the other end like a ring spanner. Both ends generally fit the same size of nut or bolt. [See Fig. 1.32 (*c*)]

4. Ratcheting ring spanner : A type of ring spanner whose end section ratchets. Ratchet action can be reversed by flipping over the spanner or by activating a reversing lever on the spanner. [See Fig. 1.32 (*d*)]

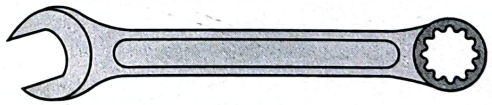


Fig. 1.32. (*c*) Combination spanner.

Fig. 1.32. (*d*) Ratcheting ring spanner.

5. Swivel head spanner : In swivel head spanner, a socket is permanently fixed to a handle. The socket can swivel around the handle to allow the user to access a fastener from a variety of angles. [See Fig. 1.32 (*e*)]

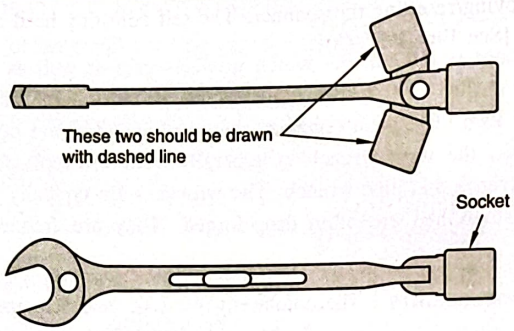


Fig. 1.32. (*e*) Swivel head spanner.

6. Pin spanner/Hook spanner/C spanner/Pin face spanner : It is a spanner with one or several pins or hooks, which is designed to turn threaded collars, retainer rings etc.

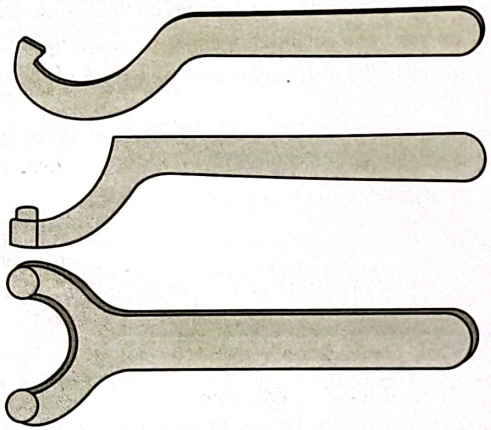


Fig. 1.32. (*f*) Pin spanner/Hook spanner/C spanner/Pin face spanner.

7. Adjustable spanner or Adjustable wrench : An adjustable spanner is also known as adjustable wrench and is used to tighten or loosen fastenings of different sizes. [See Fig. 1.32 (*g*)]

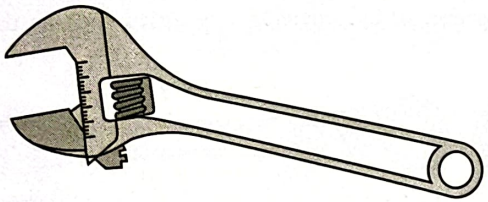


Fig. 1.32. (*g*) Adjustable spanner or Adjustable wrench.

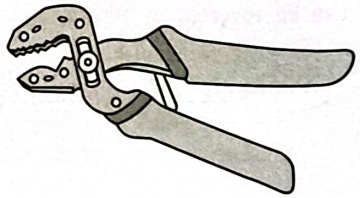


Fig. 1.32. (*h*) Self adjusting spanner or Self adjusting wrench.

8. Self adjusting spanner or Self adjusting wrench : A self adjusting spanner or self adjusting wrench automatically adjusts itself to different dimensions. It tightens and loosens nuts

and bolts without removing/resetting the spanner. The self adjusting head can instan... release the pipe also. [See Fig. 1.32 (*h*)]

9. Pipe wrench : A pipe wrench is a hand tool having hardened, serrated jaws that can securely grip soft iron pipe and pipe fittings. Its jaws can be adjusted to accommodate different sizes.

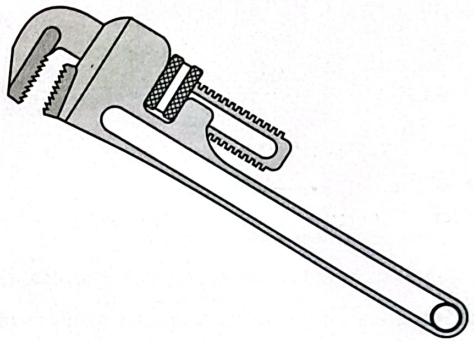


Fig. 1.32. (*i*) Pipe wrench.

10. Breaker bar or Knuckle bar or Power bar : It is a long non-ratcheting bar that allows the user to impart considerable torque to fasteners.

Fig. 1.32. (*j*) Breaker bar or Knuckle bar or Power bar.

11. Ratchet wrench or Ratchet handle : It contains a reversible ratcheting one-way mechanism that allows the socket to be turned back and forth without removing it from the nut or bolt simply by cycling the handle backward and forward. These wrenches can be used with different sized sockets. [See Fig. 1.32 (*k*)]

12. Speed handle : It is a crank-shaped handle that drives a socket. It allows the handle to be turned rapidly to quickly rotate the socket to tighten or loosen fasteners. [See Fig. 1.32 (*l*)]

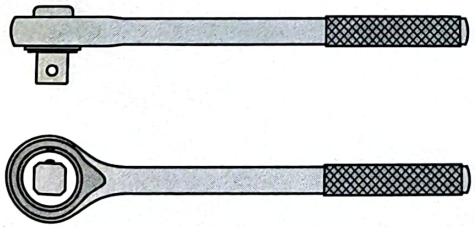


Fig. 1.32. (*k*) Ratchet wrench or Ratchet handle.

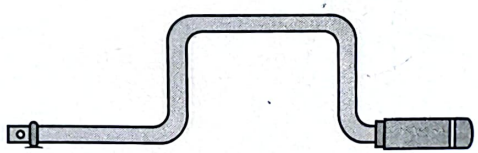


Fig. 1.32. (*l*) Speed handle.

13. Torque wrench : A torque wrench is a tool, which is used to apply a specific amount of torque to a fastener such as a nut, bolt etc. It is usually in the form of a socket wrench with an indicating scale or an internal mechanism which will indicate as by 'clicking', when a specific torque value has been reached during application. [See Fig. 1.32 (*m*)]

14. Allen key : It is a wrench which is used to turn a screw or bolt whose head is having a hexagonal socket or recess to receive the wrench. These wrenches come in two common forms: L-shaped and T-handles. [See Fig. 1.32 (*n*)]

Fig. 1.32. (*m*) Torque wrench.

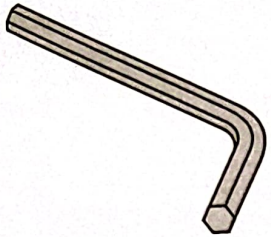


Fig. 1.32. (*n*) Allen key.

Specialized Wrenches/Spanners : Some of the wrenches/spanners falling under this category are as follows :

1. Cone spanner : A cone spanner is a thin open-end spanner used in bicycle assembly and maintenance to adjust the cones of cup and cone bearings. This wrench is very thin and therefore used in low torque applications.

Fig. 1.33. (*a*) Cone spanner.

2. Drum key : A drum key or drum tuning key is a small square-head socket wrench used to adjust the tension rods of a drum to change the pitch. It is also used to adjust drum hardware. [See Fig. 1.33 (*b*)]

3. Fire hydrant wrench : It is a pentagonal box wrench which is used to remove fire hydrant caps and open the valve of the hydrant. These are generally adjustable so as to fit different sized hydrant nuts. [See Fig. 1.33 (*c*)]

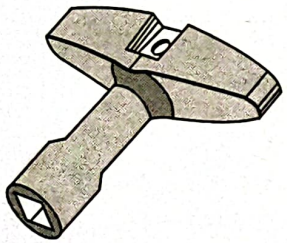


Fig. 1.33. (*b*) Drum key.

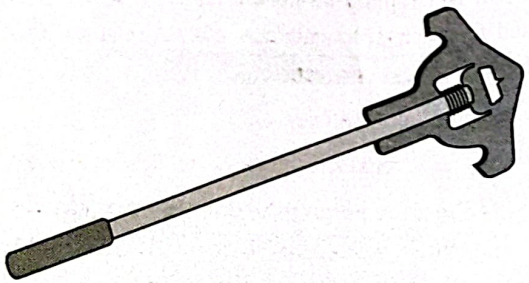


Fig. 1.33. (*c*) Fire hydrant wrench.

4. Spoke wrench : A spoke wrench or spoke key is a small wrench or tool with a clearance slot for a wheel spoke and is used to adjust the tension in the spokes of a spoked wheel such as in a bicycle wheel. A spoke wrench is sometimes called a nipple wrench, as it is the spoke nipple and not the spoke, that is turned in the process of changing the tension of a spoke.

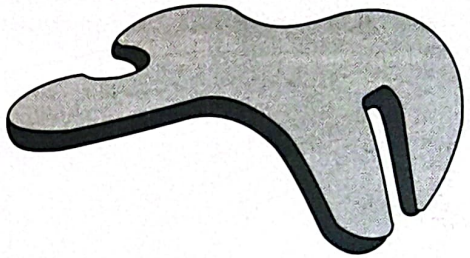


Fig. 1.33. (*d*) Spoke wrench.

5. Die stock : It is a double-handled wrench for turning the dies used in threading operations (cutting the male threads such as on a bolt).

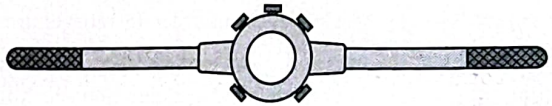


Fig. 1.33. (*e*) Die stock.

6. Tap wrench : A tap wrench is a hand tool which is used to turn the square drive on taps or other small tools used in threading operations (for example, cutting the female threads such as in a nut).

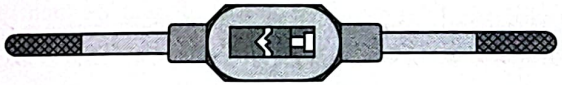


Fig. 1.33. (*f*) Tap wrench.

1.5. SURFACE PLATE

It forms the basis of measurement. These are extensively used to support jobs for marking out and form a base from which measurements are taken in workshops and metrological laboratories for the routine inspection.

These are also used :

1. as a reference or datum surface for testing flatness of surfaces.
2. as a reference surface for all other measuring instruments having flat bases like V-blocks, angle plates, sine bars, height gauges, dial gauges and comparators as shown in Fig. 1.34.

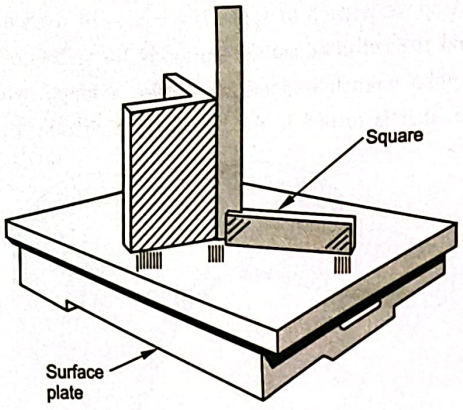


Fig. 1.34. Use of Surface Plate.

Material of Surface Plate : Closed grained cast iron is the most commonly used material for making surface plate because it provides degreee of rigidity, free from warping, capable of taking high finish and resistance to wear and corrosion. After manufacturing, the surface plate is allowed to age either naturally or by heat treatment in order to relieve stresses.

The heat treatment is carried out by keeping the surface plate in an annealing furnace and heated from 450° to 500 °C for three hours or more depending upon its size and then cooled in the open air. Finally, it is machined and scraped to truth. The edges are square and flat. Surface plates are also made of Granite and Glass. Now-a-days ceramic surface plates are also used.

Method of use : To test the flat surface of an object for truth, the surface plate is covered with 'Marking' *i.e.*, thin colour film on which the object to be tested is slightly rubbed. The marking will be transferred to the face of the object, indicating the high spots.

Precautions durings use of surface plate :

1. The surface plate is used as a reference or datum surface and needs to be protected from damage. Care should be taken that measuring instruments donot drop on its surface.
2. It should be firmly supported on the stand and levelled.
3. The full available area of the surface plate should be used to ensure equal wear as far as possible.
4. The variation in local flatness if any should be checked occasionally.
5. Before use its top surface should be cleaned from dust and other particles.
6. After use the surface should be coated with anti – corrosive liquid such as petroleum jelly or oil or grease etc.
7. When surface plate is not in use, it should always be kept covered with a flat lined wooden cover.

1.6. V-BLOCK

It is made from closed grained cast iron with all the faces machined true. V-grooves are provided on two opposite sides and slots on other two faces as shown in Fig. 1.35. V-blocks are classified by the maximum diameter of the work which can be held between two identical blocks, when one is inverted over the other. Generally, the angle of V is 90° and they are made in identical pairs, each pair is stamped with the same number or symbol.

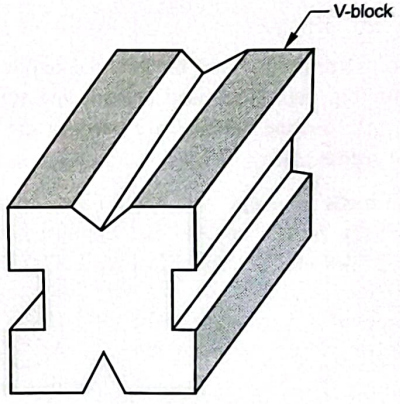


Fig. 1.35. V-Block.

V-blocks are mainly used for :

1. Holding the cylindrical work-pieces for marking centres.
2. Checking the roundness of cylindrical work-pieces.
3. Supporting the rectangular components.

The height of the V-block can be raised by means of adjustable parallel strips or by bolting them to angle plates. A clearance at the centre of V is given to accommodate the burrs on the edges of rectangular or square jobs and this ensures correct seating.

1.7. FILES

Files are used in every metal and fitting workshop. The files are multitooth tools. Files are made up of hard steel and these are used to remove the material by rubbing them on the metal. Files are available in a number of sizes, shapes or cross-section and degree of coarseness.

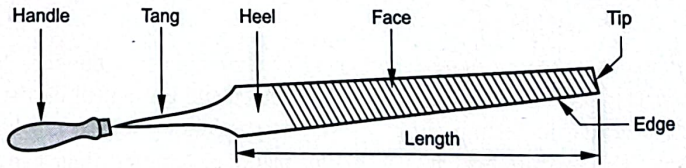


Fig. 1.36. Parts of a file.

Classification of files is as follows :

1. Classification on the basis of grade :

(*i*) Rough – 20 teeth per inch.

(*ii*) Bastard – 30 teeth per inch.

(*iii*) Second cut – 40 teeth per inch.

(*iv*) Smooth file – 50 teeth per inch.

(*v*) Dead smooth – 100 teeth per inch.

The rough and bastard files are used where the material removing is more. These files have bigger teeth and are used for big cuts. The dead smooth and smooth files have smaller teeth and are used for finishing work. Second cut files are between the bastard and smooth files and are also used for finishing purpose.

2. Classification on the basis of shape and size : Files are available in various sizes and shapes. The length of files vary from 4″ to 14″ and the shapes are available in flat, square, round, triangular, half round files etc. as shown in Fig. 1.37.

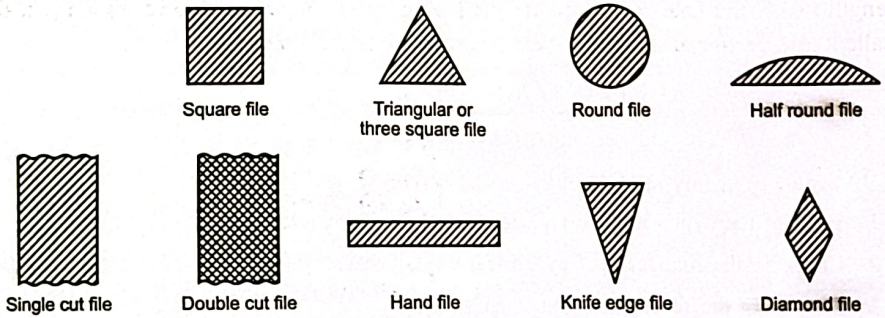


Fig. 1.37. Cross-sections of files.

3. Classification on the basis of number of cut of teeth : According to the cut of teeth, the files have two categories *i.e.,* single cut files and double cut files. In single cut files, the teeth are cut in parallel rows at an angle of 60° with the centre line of the face. Another row of teeth is added in the opposite direction in case of double cut files. Single cut files give a better finish as compared to the double cut files but material removing rate is more in double cut files than in single cut files.

Pitch of teeth : The spacing between the teeth is known as pitch of the teeth and the number of teeth in one centimetre is called the pitch of the file. The number of teeth varies from 10 to 40 in one centimetre.

The file should be used in perfect horizontal position. Most of the files have their teeth pointing in forward direction. The pressure of the hand should be applied on the forward stroke only and relieved during the return stroke. As far as possible try to use full length of the file during operation. The work is held in a vice after marking. Keeping right hand on the handle and left hand on the front end, file is moved to and fro with the speed of 20 to 30 strokes per

minute. Rough and coarse files are used where the material removal rate is [illegible] and smooth files are used where the finishing is required in work.

Care of files : The following points should be kept in mind while working and storing the files :

(*i*) Always store the files in wooden racks.

(*ii*) File cleaner should be used for cleaning the files after working.

(*iii*) Files should be always coated with oil to protect them from rust.

(*iv*) The teeth should be protected from excessive wearing.

1.8. SURFACE GAUGE

It is a principal marking tool in a fitting shop and is made in various forms and sizes. It is made up of high carbon steel and is hardened from the front edge. The marker or scriber is fitted into an adjustable device carrying a nut at one end. With the help of nut, the scriber can be loosened or tightened to set it at any desired inclination, height and length inside the hole. It is used for marking of lines. Scriber mounted on a vertical bar is called surface gauge. A heavy base is provided at the bottom.

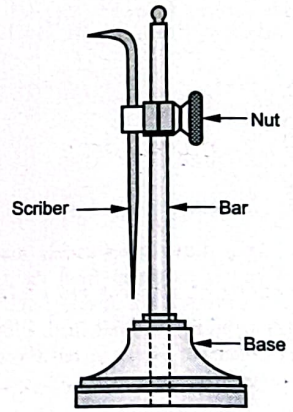


Fig. 1.38. Surface gauge.

Important and Expected Questions

Q.1. What is chisel ?

Ans. A chisel is a cutting/chipping tool having a sharpened edge at the end of a metal blade. Depending upon application, its edge can be beveled at a variety of angles. It is used to chip, carve or cut into a solid material (such as wood, stone or metal) often by driving with a mallet or hammer. It may also be provided with a handle which is made up of either wood or plastic.

Q.2. What is firmer chisel ?

Ans. It is a general purpose chisel used to finish the inside grooves of any wood. It has various sizes of cutting edge depending upon the work to be done. The width of blade varies from 3 mm to 38 mm and is rectangular in cross-section. It may be used either by hand pressure or by blows from a mallet.

Q.3. What do you mean by stone chisel ?

Ans. Stone chisels are used to carve or cut stone, bricks or concrete slabs. To cut stone, a brick bolster is used. To increase the force, stone chisels are often hit with club hammers, which is a heavier type of hammer. Stone chisels are carbide tipped or are made up of high carbon steel.

Q.4. What is saw ?

Ans. A saw consists of a thin metallic blade having a series of sharp teeth on one edge or a thin metal disc with teeth on the periphery. Generally the teeth are bent alternately to the right and left side, so that the groove cut by the saw is wider than the thickness of the saw blade. This arrangement of teeth enables the saw to easily pass through the cut being formed and with minimum friction. Each tooth cuts away a small portion of material. At one end of the blade, a wooden handle is fitted by riveting. The saws are available in various shapes and sizes. The size of the saw is generally specified by the length of the blade and pitch of teeth in mm.

Q.5. Enlist the various types of saw blades.

Ans. The various types of saw blades are as follows :

(*i*) Band saw blade

(*ii*) Crosscut saw blade

(*iii*) Rip saw blade

(*iv*) Plywood blade

(*v*) Dado blade.

Q.6. What is surface gauge ?

Ans. It is a principal marking tool in a fitting shop and is made in various forms and sizes. It is made up of high carbon steel and is hardened from the front edge. The marker or scriber is fitted into an adjustable device carrying a nut at one end. With the help of nut, the scriber can be loosened or tightened to set it at any desired inclination, height and length inside the hole. It is used for marking of lines. Scriber mounted on a vertical bar is called surface gauge. A heavy base is provided at the bottom.

Objective Questions

► Fill in the Blanks ◄

1. A ..... is a cutting/chipping tool having a sharpened edge at the end of a metal blade.
2. ..... chisel is used to split stone and is struck with a hammer.
3. Warrington hammer is preferred for work that requires ..... .
4. ..... hammer is used for striking as well as for pulling out the nails from the wood.
5. Square face hammer is also known as ..... hammer.

6. The width of the saw cut or the width of the narrow channel left behind by the saw while cutting is called ..... .
7. The valley between the points of the teeth is known as ..... .
8. The distance between the adjacent cutting edges is called ..... .
9. Compass saw carries a tapered narrow blade having length about ..... cm.
10. The process of bending the alternate teeth of a saw in opposite directions is known as ..... .

► True or False ◄

1. The paring chisels are similar to Firmer chisels, but they have a short thin blade and a sharper edge.
2. A gouge typically has a 'L'-shaped cross-section.
3. Stone chisels are used to carve or cut stone, bricks or concrete slabs.
4. Ball peen hammer is mainly used for chipping and riveting.
5. Fleam, also known as bevel, is the angle that the front (face) of the tooth makes with a line drawn perpendicular to the plane of the saw blade.
6. Rake is the angle that the front (face) of the tooth makes with a line perpendicular to the length of the saw blade.
7. The files are multitooth tools.
8. Scriber mounted on a horizontal bar is called surface gauge.

ANSWERS

Fill in the Blanks :

1. chisel	2. Tracer	3. precision
4. Claw	5. setting	6. kerf
7. gullet	8. pitch	9. 45
10. setting of teeth		

True or False :

1. False	2. False	3. True	4. True	5. True
6. True	7. True	8. False		

Review Questions

1. What is chisel ? Also, enlist the various types of chisels.
2. Differentiate between stone chisel and masonry chisel.
3. What is hammer ? Also, state the various types of hammers.
4. What are sledge hammers ?
5. Differentiate between rip saw and compass saw.
6. What are spanners ?
7. What is V-block ?
8. What are files ?